Assimilation Development and Experiments: Ocean and Sea Ice

MERROcean by Vernieres
Operation: 1978-present, MOM4p1, ½ degree, EnOI, Covariance from joint EOFs of coupled model, Altimetry infers 3-D temperature, O-F
Development: Skin SST, wave model, ¼ degree, MOM5, Aquarius SSS

GODAS OSE by Xue
TAO/TRITON important for constraining equatorial temperature
Argo important for constraining off-equatorial temperature, overall quality of salinity, SSH and surface currents
GODAS drawbacks: 1) too strong fit to data?; 2) damped salinity variability

HYBRID-GODAS by Penny
3DVAR combines with LETKF, reanalysis for 1991-2011, 56 ensemble members forced by 20CR, RMS and mean of O-F reduced with time

SODA by Carton
MOMv5.1, ¼ degree, 1979-present, ERA-Interim, Bias correction, Hybrid, O-F, A-F, challenges in sea ice analysis

NSST by Li
Near sea surface temperature (NSST) model for diurnal thermocline layer warming and thermal skin layer cooling in GFS. To be implemented in CFS

ENSO in SODAs by Giese
20CRv2 → SODAsi.2 → 20CRv2c → SODAsi.3, 1916-1920 sparse obs, 1997/98 dense obs., two large El Ninos, prescribing SST to the atmosphere reduces uncertainties in surface forcings, reduces spread

GLDAS by Meng
Upgraded Noah Land, new land data, improve land data assimilation scheme, CPC daily prec., stream flow, GLDAS2 single stream replay compared to CFSR, land surface spin up more critical in dry land

Sea Ice by Wu
NAM, GFS, CFS, RTOFS, CFSv3

Eddy resolving model by Keppenne
High resolution coupled model

- **Outstanding issues**
  - Jumps due to introduction of new observations; Should we reduce jumps, which may represent a better analysis and show model biases? Changes in observations also lead to changes in surface fluxes, leading to changes in background covariance and jumps in ocean reanalysis
  - Sea ice extent and sea ice thickness analysis before satellite era?
  - NSST is used to integrate satellite data and resolve diurnal mixed layer
  - Improve salinity, mixed layer depth, deep ocean analysis

- **Data assimilation streams**
  - Both ocean, land and stratosphere need spin up of 2-5 years
  - Climate forecast requires continuous climate reanalysis without artificial jumps for calibrating model climatology and model hindcast skill
  - Running a low resolution of coupled data assimilation system could provide initial conditions from which different streams can be initialized

- **Recommendations**
  - Examine F-O and F-A and evaluate impacts of observations and data assimilation scheme on ocean reanalysis
  - Ensemble data assimilation
  - Coupled data assimilation
  - Eddy resolving model needed?